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Celtis pumila Pursh, with Notes on allied Species

BY E. J. HILL

(WITH PLATE 33)

Since 1889 I have had under observation the species of *Celtis* which grow in this vicinity—*C. occidentalis* L. and the one that generally goes under the varietal name of *pumila* A. Gray, regarded as the equivalent of *Celtis pumila* Pursh. Since finding the latter in 1893 the impression of their difference and the title of the latter to specific distinction have increased until at last I am convinced it should be restored to the rank assigned it by Pursh. This conclusion was communicated to Dr. N. L. Britton in a letter, July 19, 1899. *Celtis occidentalis* is a forest tree, here mostly found by the banks of streams or contiguous to them and is most common by the Desplaines River. It also occurs in the lower or more swampy sand region at the head of Lake Michigan, where it is seen sparingly on low sand ridges which border or divide from each other the shallow lakelets near the boundary of Indiana and Illinois. *Celtis pumila* is found in the dry dune region and is confined to a narrow belt extending east and west of the mouth of the Grand Calumet in Indiana, not yet seen beyond half a mile from Lake Michigan. A full description will be given of *C. pumila* alone; only points of comparison between *C. pumila* and other species of the genus need be added.

CELTIS PUMILA Pursh

A bushy straggling shrub, 0.75–4 m. high, often in clumps as broad as high, sometimes with ascending stems 4–5 m. long and 8–10 cm. in diameter. Branches divaricate or much divergent, usually making a wide angle with their support, often a right angle or even slightly directed downward. They are scraggy, abundantly furnished with short twigs 3–10 cm. long, which frequently end in a stiff, leafless, thorn-like point, due to winter killing, and giving them the appearance of a thorn-bush. The bark is thin, gray, smooth or a little roughened at the base. The new branch-



HILL ON CELTIS.

lets are puberulent, brown or reddish, often tinged with gray. The older branches are gray, with numerous small, oval or roundish, slightly elevated lenticels, lighter than the bark. Winter buds minute, 1–2 mm. long, triangular-ovate, flattened by pressure against the stem, furnished with two or three series of brown puberulent scales. Stipules linear-oblong, scarious, membranaceous, caducous, yellowish; margins hairy, often fimbriate. Leaves on petioles 1–1.5 cm. long, broad-ovate to oval or oval-oblong, acute to acuminate, mostly short-acuminate, sometimes a little falcate, 5–8 cm. long by 2.5–5 cm. wide; base commonly very oblique, sometimes rounded, rarely slightly heart-shaped; the margin entire to serrate in various degrees above the lower fourth. Sometimes they are prominently and quite evenly serrate on both margins, with callous-tipped, slightly incurved teeth, or on one side only, the teeth varying in position, number and prominence, often reduced to one or two. The leaves are puberulent when young, smooth or a little scabrous as they mature, usually thickened with age; light green or somewhat glossy above, frequently mottled with lighter colored spots, paler beneath; veins lighter and prominent on the lower surface, with many anastomosing veinlets. In autumn they turn to a pale or greenish yellow.

The flowers appear with the expanding leaves in May. The staminate are caducous, on slender recurved pedicels in groups of two or three, mostly three, on the basal part of the twigs in the axils of minute bracts or of the lower leaves, sometimes much crowded on short twigs and appearing racemose. The perfect flowers are usually solitary, on slender ascending pedicels from the axils of leaves above the staminate, or single and central in a staminate group. Sepals 4–6, mostly 4 or 5, thin, membranaceous, incurved-spreading, oblanceolate to oblong-linear or linear, boat-shaped, hairy, greenish to yellowish-green, frequently tinged with red, apex entire or sometimes lacinate; fringing hairs long. The stamens are 4–6, those of the sterile flowers rising from a torus covered with a dense white tomentum; filaments smooth, stout and tapering, bent inward before anthesis, bearing the oblong introrse anthers attached below the middle in an erect position. During anthesis they straighten, raising the recumbent anthers nearly to the top of the sepals, the filaments being shorter than

the anthers and barely more than half the length of the sepals. In the perfect flower the anthers are erect, emarginate, nearly sessile and included, smaller than in the sterile. The vase-shaped ovary rises from a torus of dense white tomentum, and is glossy green. The stigmas are long, spreading or a little recurved, 8–10 mm. across when expanded, the tips generally strongly incurved or rolled inward, densely clothed above and around the ends with white, more or less papillose, hairs, the smooth green strip beneath being very narrow. The fruit is single, globular, 6–8 mm. in diameter, on ascending pedicels about the length of the petiole (9–12 mm.). It varies in color from bay or light brick to chestnut or even sooty when very ripe; it has a thick, tough skin and a thin, orange-colored, sweet flesh. The nutlet is globose, slightly higher than wide, sometimes a little flattened longitudinally, 5.5–6 mm. high by 5–5.5 mm. in diameter; the thick, white wall coarsely reticulated on the outer surface, pale orange and lustrous within. The pits are shallow, their bounding walls broad and rounded. The seed is covered by a thin, white, membranous coat marked at the chalaza by a dark circular spot. The fruit sometimes persists on the branches during the winter, but is apt to be eaten by birds.

Celtis pumila ranges from Delaware and Pennsylvania to Kansas, Colorado and Utah, and southward along the Atlantic border. It inhabits sand dunes, rocky places, rocky banks of streams, dry hills and mountains, being generally xerophytic in habit.

Specimens have been examined in the herbarium of the Field Columbian Museum from Delaware (W. M. Canby, *C. occidentalis* L. var. *pumila* Gray), from Pennsylvania (Traill Green, *C. occidentalis* L., Easton, Pa.); in the herbarium of J. M. Coulter, University of Chicago, from Kansas (No. 44, J. E. Bodin, *C. occidentalis* L. var., described as a large shrub or small tree about 15 feet high, "growing on rocky creek banks on limestone ground.") Besides material of *C. occidentalis* collected in various places in the vicinity of Chicago, specimens from different regions were available for comparison in the above herbaria, though unfortunately nearly always with immature fruit. Excellent fruit from Stark Co., Ill., was furnished by V. H. Chase. Specimens of *C. reticulata* Torr. were examined in the herbarium of J. M. Coulter from Bowie,

Arizona, coll. Marcus E. Jones (with mature fruit) and from river bottoms, Oregon, coll. Drake and Dixon, Portland, Oregon. Also examples of *C. Mississippiensis* Bosc from various stations in the Mississippi valley were examined in the two herbaria.

The characters of *Celtis pumila* Pursh place it between *C. occidentalis* L. and *C. Mississippiensis* Bosc. Its fruit characters, especially as seen in the nutlet, bring it much closer to the latter and to *C. reticulata* Torr. (or *C. Mississippiensis* var. *reticulata* Sargent, if considered a variety). It very often has the entire leaves of *C. Mississippiensis*. The leaves of this species are narrower and relatively longer, but when short and broad approach those of *C. pumila*. Sometimes the leaves of *C. occidentalis* resemble those of *C. pumila* if the latter has them rather closely and evenly serrate on one or both margins, as in the specimen of W. M. Canby from Delaware. It is also seen in examples of the common hackberry from the Desplaines River in which the leaves are considerably thickened at fruiting time like those of *C. pumila*. The leaves of *Celtis occidentalis* are prevailingly much longer acuminate, thinner, though with a tendency to thicken in autumn, frequently scabrous, more apt to have a cordate base or one less oblique, and often become much larger. Being a tree, it has a trunk roughened by the peculiar bark of narrow, prominent, broken ridges so characteristic of the hackberry. The shrubby habit and peculiar mode of branching of *C. pumila* (that of *C. occidentalis* usually being ascending or making a sharper angle with the support) are features that at once strike the eye. The smaller winter buds, the flowering season from 10 to 15 days later than that of *C. occidentalis*, greener flowers with longer stigmas, commonly more hairy and more nearly entire sepals, shorter filaments, smaller, globular, lighter colored fruit, and especially the smaller globose nutlet with a white reticulated pitted surface, seed covered with a white membrane (that of *C. occidentalis* being light brown or dark brown near the black spot of the chalaza), are the most distinctive characters of *C. pumila* as compared with *C. occidentalis*.

A comparison of the nutlets of four species, enlarged 8 diameters, is given in connection with the text figures 1-4.

CELTIS OCCIDENTALIS. Fig. 1

Nutlet pale to dark fuscous, higher than wide, $6-8 \times 5-6$ mm., slightly obovate, apiculate, unsymmetrical. Surface more regularly reticulated, the pits deeper, the walls a little sharper than in *C. pumila*.

FIG. 1.

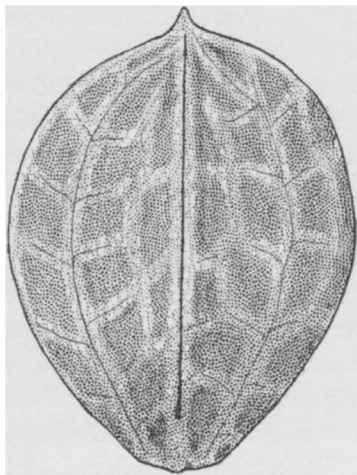


FIG. 2.

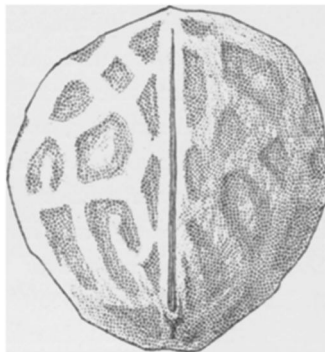


FIG. 3.

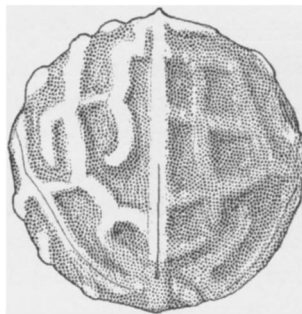


FIG. 4.

CELTIS RETICULATA. Fig. 2

Nutlet grayish-white, globose, 6×5.5 mm., unsymmetrical. Surface irregularly and coarsely reticulated, pits rather deep, larger ones raised in the center, bordering walls broad.

CELTIS PUMILA. Fig. 3

Nutlet white, $5.5-6 \times 5-5.5$ mm., globose or nearly spherical, being slightly higher than wide, bluntly apiculate. Surface coarsely reticulated, the pits shallow, the bordering walls broad and rounded.

CELTIS MISSISSIPPIENSIS. Fig. 4

Nutlet yellowish-white, 5×5 mm., globular, minutely apiculate. Surface reticulations irregular, the pits deeper and bordering walls sharper than in the others.

Another form, not figured, is worthy of notice. It is from a specimen in the herb. of the Field Columbian Museum, no. 63720, *C. occidentalis* L., coll. J. R. Lowrie, 1874, "barrens of Huntingdon Co., Pa." The nutlet is globose, a little higher than wide, 6.5×5 mm., in size and shape between that of *C. pumila* and *occidentalis*, light tan-colored. The reticulations, pits and their bordering walls are similar to those of *occidentalis*. The leaves are thinnish, larger than in *C. pumila*, slightly serrate, shaped much as in *C. occidentalis*. The specimen shows a branching rather spreading or divaricate, akin to that of shrubs in the dune region of Indiana. It has characters intermediate between *Celtis pumila* and *C. occidentalis*, but nearer the latter. It may be distinct but the material is too scanty to decide. Hybridity is also suggested.

My experience with the floral habits of the two species of our region in 1898 and 1899 well illustrates their difference and is worthy of record for its ecological bearings. It is a matter of long observation that the cold air of Lake Michigan retards the anthesis of plants growing near the shore. There may be a difference of a week within a distance of ten miles, as seen in the same species growing by the Desplaines River, about that distance away. *Celtis pumila* in the dune region is from one fourth to one half a mile from the shore. *C. occidentalis* at Wolf Lake and vicinity is from two to three miles from the shore. *C. occidentalis* along the Desplaines is about eleven miles from the lake. On April 28, 1899, this was collected at Wolf Lake in full bloom, the trees being yellow with the flowers. The day after those at Maywood on the Desplaines were examined. The staminate flowers had nearly all fallen off, showing that the anthesis would have been in the condition of

those at Wolf Lake three or four days before, or about April 25th. On May 16th, *C. pumila* along the Grand Calumet near Miller was visited. It was a little late, the staminate flowers were nearly all gone and the perfect in about the same stage as those of *C. occidentalis* at Maywood on April 29th, showing that their anthesis occurred about the 12th of May. The previous year, May 25, 1898, *C. pumila* near Miller was examined. The shrubs were well covered by the greenish yellow flowers, the leaves small, from 2-3 cm. long by 1-2 cm. wide. Two days after, May 27th, I was at Maywood and was surprised to see *Celtis occidentalis* so much more advanced. It did not seem to be due to the mere difference of temperature between the lake shore and the river valley, and offered quite a strong plea for their specific distinction. The fruit on the Maywood trees was well advanced, as large as small peas, or about 5 mm. in diameter, the leaves quite large, 5-8 cm. long by 2-5 cm. wide. On May 18, 1899, *C. occidentalis* at Wolf Lake was essentially in this stage of development and may be compared with those of *C. pumila* at Miller two days before. The leaves of *C. pumila* were then 1-3.5 cm. long and 0.5-2 cm. wide. The largest on *C. occidentalis* at Wolf Lake were 9 by 5 cm. These stations, that by the Grand Calumet and Wolf Lake near Whiting, are best for direct comparison. Both are in the sand region of Lake Michigan, both subject to the same atmospheric factors of the lake air. The trees at Wolf Lake grow in sand and gravel washed up by waves or heaped by the winds, on rather low land raised 5 to 10 feet above the level of the lakelets or bordering marsh, but near enough to water to be moist for trees, being accompanied by elms, basswood, the white and blue ash. The shrubs by the Grand Calumet or on the lake dunes grow in loose dry sand, though their deeper roots get a fair degree of moisture, the surface being from 10 to 50 feet above the river or the level of Lake Michigan. The trees by the Desplaines are in the drift formation, the subsoil a stiff unctuous clay, the surface a clay loam very sticky when wet. The data give a difference of ten to fifteen days between the two species in the sand region and of four to six days in the same species in the two stations, Wolf Lake and Maywood, in 1899. It is of interest to note in this connection that one of my time-keepers for the anthesis of *C. pumila* is an orchid, *Cypripedium*

acaule, growing in depressions of the sand hills in the vicinity of the shrub. Both can be obtained in bloom on the same occasion and have always proved true to time.

The vicissitudes of plant nomenclature are well illustrated by the changes of name to which *Celtis pumila* has been subjected. The first mention of it is by Muhlenberg (Catalogue, 95. 1813) where *C. occidentalis* β *pumila* is given. The description is brief, but items set down in connection with it apply—"dwarf, fruit a one celled globose drupe, fl. May; habitat Penns." Pursh (Fl. Am. Sep. 1: 200. 1814) seems to have taken up the name of Muhlenberg, giving it specific rank but not mentioning that of Muhlenberg as a synonym. The description, though short, applies essentially to this form. "*C. foliis ovatis acuminate aequaliter serratis basi inaequalibus utrinque glabriusculis, junioribus tantum pubescentibus pedunculis subtrifloris, fructu solitario. On the banks of rivers, Maryland and Virginia, May, v. v. A small straggling bush; berries ovate, black.*" The "*v. v.*" indicates that Pursh had seen the plant in a living state. The early botanists mainly copied the description of Pursh as one sees in Beck (Bot. North. and Mid. States, 334. 1833) and in Eaton and Wright (N. Am. Bot. 186. 1840). The berries are described as brown and glaucous in both books. Beck gives Muhlenberg's var. *pumila* as a synonym. Nuttall (Gen. 1: 202. 1818) gives as a third species, *C. occidentalis* and *C. crassifolia* having been mentioned, "*C. tenuifolia. C. pumila*, Pursh 1, p. 200? A low bush in the mountains of Virginia, flowering at the height of 2 feet. Leaves nearly as broad as long, now and then without serratures, often cordate-ovate, very little acuminate and almost perfectly smooth on both sides. Berries solitary, brown and glaucous." Torrey (Fl. N. U. S. 300. 1824) adds this account of Nuttall to the description by Pursh, not questioning its distinctness, though like Nuttall, he does that of *C. crassifolia* Lam. He adds the *C. occidentalis* β *pumila* of Muhlenberg's "Catalogue" as a synonym of *C. pumila* Pursh but with the mark of doubt. The treatment of *Celtis* by Rafinesque in his monograph of the genus (New Fl. N. A. 3: 31. 1836) is characteristic. Fifteen species are made, six of them shrubby. The name *pumila* is appropriated as his own, being made the equivalent of "*C. occid. var. pumila* Mg. and some others

but not Pursh and his copists." He adds: "This is marked in Collins' Herb. as the real *pumila* var. of Muhlenberg, but it appears that all of our 6 shrubby sp. must have been blended under this name; I shall now distinguish them properly although the synonyms are difficult to fix, owing to all copying Pursh rather than describe what they saw." It would appear from this that he had seen some of the forms at least. His *C. pumila* is a small low shrub only two feet high or long, being procumbent; the leaves were short, "hardly an inch long, hardly acuminate, rather acute, very thin and green with very large teeth." He concludes: "The large teeth and truncate base [of leaves] will distinguish this from all others besides the procumbent stem."

Another species is "*Celtis tenuifolia* Raf. (or *parvifolia*), *C. pumila* Pursh, T. B. & C. *C. occid.* var. *tenuif.* Lam. Pers. Nuttall? etc.—shrubby erect branches divaricate, branchlets angular smooth leaves uniform ovate acuminate, serrulate in the middle, base acute obliquial unequal entire trinervate, both sides smooth, pedicels axillary uniflore longer than petioles, fruits round oboval brown—shrub 3 to 5 feet high, erect with spreading branches, found by myself in the hills of Maryland, blossoming in May, said to grow also in the Mts. of Virginia and in Louisiana, easily known by the few small teeth, leaves 1 or 2 inches long, rather thin." On the whole this description best accords with those I find in northern Indiana. Under *C. heterophylla* Raf., sent him from Alabama, he finds "a very singular species offering all kinds of leaves on the same small branches (1 or 2 inches long) yet unlike any of the other shrubby kinds." This variability of the leaves is often shown by the Indiana shrubs. As Darlington lived in the region where *Celtis pumila* was first observed, Chester County, bordering Lancaster County, the home of Muhlenberg, on the east, it is well to notice how he treats the form in his *Flora Cestrica* (180. 1837). He observes that *C. occidentalis*, as known to him in Chester County at least, is rather a large shrub than a tree, being eight to fifteen feet high. "It very much resembles, moreover, some small specimens which I collected on the *Potomac* above Georgetown,—which Mr. Schweinitz pronounced to be *C. pumila*; and hence have led me to suppose that Muhlenberg was correct in making *C. pumila* a variety of *C. occidentalis*."

As Schweinitz was a Pennsylvanian (born 1780) and became a correspondent of the elder Muhlenberg toward the close of his life, somewhere after 1813, when Muhlenberg first heard of him,* it seems that he would have known Muhlenberg's variety *pumila* at first hand and that it was the *pumila* of Pursh. Since one seen by Rafinesque was in the herbarium of Collins, who was a resident of Philadelphia, and a familiar friend of Muhlenberg, it is also evident that Collins knew the *C. occidentalis* var. *pumila* of Muhlenberg directly. This goes far to prove the identity of the two forms as well as the reasonable priority of Muhlenberg's name in this case, unless we entirely rule out the "Catalogue" as an authority for nomenclature. In my opinion the name should be written *Celtis pumila* (Muhl.) Pursh.

Plate 33 shows flowering and fruiting branches and winter buds, natural size, the perfect and sterile flowers and nutlet enlarged 5 diameters.

CHICAGO, Aug. 1, 1900.

* In a letter dated Lancaster, Dec. 13, 1813, Dr. Muhlenberg writes: "It is only today that I hear of an excellent *Mycologist* in North Carolina, who is a teacher among the Moravians at Salem, and has written upon the *Fungi* in Germany. His address is Rev. L. David de Schweinitz at Salem, North Carolina." (Darlington's *Reliquiae Baldwinianae*, 119, 1843.) They subsequently corresponded.